

broken off where their diameter was as much as 4 feet. From examination of the age of trees destroyed, the observer concluded that this was the most destructive storm within 200 years (5).

The Miami Beach record therefore stands as the highest recorded by automatic instruments in the United States.

Engineers and others seeking to apply these velocities to structural problems will find information concerning the average pressure tending to overturn a model in Scientific Paper of the Bureau of Standards No. 523 (6).

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### DESTRUCTIVE GUST AT JUPITER, FLA., FOLLOWING THE MIAMI HURRICANE

By H. B. BOYER, Meteorologist, In charge

(Weather Bureau office, Key West, Fla., October 4, 1926)

Attention is called to a freakish gust of wind of hurricane force that was experienced at Jupiter, Fla., on September 18, during the tropical storm of that date. This gust practically demolished the naval radio station at that place.

The gust that caused so much damage to the Jupiter radio station was unique in that its destructive force was confined to a narrow and well-defined path running from south-southeast to north-northwest with a width of about 400 feet.

A remarkable feature of this gust was that it occurred during a recrudescence of the storm and after the center

had crossed the Florida Peninsula and was well off the west Florida coast.

Blowing with hurricane force from the northeast and east throughout most of Friday night, the wind veered to southeast and south on Saturday, gradually diminishing in velocity to a whole gale. This was in the natural order of events in a tropical storm whose center was moving on a westerly track to the southward of a given point. In all tropical hurricanes, within the area of hurricane winds, the most destructive are those that occur after the center has passed the gusts being of greatest violence and force, but diminishing in frequency and strength as the center recedes. At Jupiter there was a renewal of the storm to hurricane force during Saturday afternoon, the terrific gust that put the radio station out of commission occurring between 8 and 9 p. m.

\* \* \* In the area of great destruction one anchor of the 200-foot north tower containing 12 cubic feet of concrete was completely pulled out of the ground. Part of the roof of the dormitory was blown southward and deposited on the pier. This, in all probability, was done by an eddy, as there was no other evidence that the gust partook of the nature of a tornado.

E. C. Seibert, public works officer, communicates the following:

It appears as though the majority of the damage at Jupiter was done in a very short space of time, 20 or 30 seconds, or even less. Shortly after 8 p. m., September 18th, a very sudden and marked increase in the wind velocity was noted by the personnel, and before the operator in the operating building could get out, the roof was off and the towers were down. No one witnessed the actual falling of the towers. From the manner in which brush and trees were knocked down, and from its effect on various structures, it appears that this sudden volume of wind was very narrow in width, perhaps only about 400 feet. It seems to have run just a few degrees west of north, wrecking the boathouse and carrying away the operating house roof, north and northeast towers, garage, etc. An old empty wooden tank on a comparatively light steel tower on the lighthouse reservation (to the east) was uninjured, although the tank, it is understood, is not fastened down to the top of the tower except by the effect of the riser pipe from the pump. This tank is only about 500 feet east of the operating building. In other words, the eastern extremity of this cyclonic gust seems to have been about 250 feet east of the operating house, while its western boundary was probably 150 feet. Also, the quarters on top the hill, to the east, and known as the old Weather Bureau House, was not materially damaged.

### THE HURRICANE AT TURKS ISLAND, SEPTEMBER 16, 1926

By GEORGE GOODWIN

(Turks Island, West Indies)

At the 8 a. m. readings the weather had taken a very unfavorable change—barometer tending to fall and wind increasing and dropping every few minutes.

On receipt of advice from the bureau that the storm would pass over or near Turks Island, every available means was used to spread the information, that all necessary precautions might be taken. Since the barometer was falling rapidly a special observation was taken at 10:20 a. m. and all particulars sent to the bureau. Wind was then blowing at 36 m. p. h. from NW, with very heavy sea swell. Rain falling. At 1 p. m. the velocity of the wind had increased to 100 m. p. h. NW., with a very heavy sea swell, the intensity of the storm gradually increasing. A special observation was sent to the bureau. At this hour the office was flooded and the sea breaking over the top, carrying all before it. Huge blocks of cement weighing a ton being washed around as if mere pebbles. At 1:55 the storm had reached such intensity as to indicate that everything would be demolished. Wind then about 150 m. p. h., unroofing the

office buildings, the roof of corrugated iron being carried about one mile inland. The sea swell at times was well above the window sills and before it could recede was caught by the next swell, the sea reaching inland for about three-quarters of a mile. The rain and sand at this time were blinding. The wind was so intense that the prickles from the prickly pear were blowing about like dust, being stripped off as the wind would strip a tree of its leaves.

At 5 p. m. it was deemed advisable to take shelter at the commissioner's residence. It took fully 40 minutes to cover a distance of less than a quarter of a mile; after a fierce fight we managed to reach our destination.

At 9:30 p. m., the storm having abated somewhat, the wind suddenly veered round to SE., still of a velocity of about 80 m. p. h.

The instruments of the bureau suffered badly. Cups of the anemometer were found half a mile away. The shelter with the thermometers was blowing around as if a sheet of paper. When eventually picked up it was

found to have sustained little damage and was easily repaired. I was unable to take readings until the 6th of October, unfortunately the clockwork of the barograph having got wet, and sand having found its way into the works of the anemometer register, the whole thing being wrecked. I was able to construct a makeshift from parts on hand \* \* \*.

To illustrate the force of the water from the swell: A small boat of 14 feet \* \* \* was hauled up in front of my residence situated on Front Street. This boat was carried over the abutment, over a 4 ft. 6 in. gate, round the yard, knocking down an outbuilding and finally coming to anchor by my carriage house. The sea rushed through my residence as if a river, at times being knee

deep. Sand from the beach in the yard was above one's knees. The island even now is a perfect wreck and will take a large amount of money and time to put in any state of order \* \* \*.

Date	Hour	Barometer	Wind	Sky	Sea
Sept. 15.		29.910	NE., 10 m.p.h.	Clear	
Sept. 16.	8 a. m.	29.751	NW., 18	Cloudy	
	10:20 a. m.	29.630	NW., 36	Cloudy	Heavy swell.
	1:00 p. m.	29.265	NW., 100	Cloudy	Very heavy swell and intensity of storm increasing.

Measured precipitation 10 inches and rain still falling. Heavy swell carried rain gage some distance inland.

### A. ÅNGSTRÖM ON "RADIATION AND CLIMATE"

55/590.2 : 55/524

By H. H. KIMBALL

[A review of *Geografiska Annaler*, 1925, H. 1, och. 2]

The paper deals principally with the heating effect of solar radiation received by the earth. It is based upon measurements made at or near Stockholm, Sweden, of the total radiation received on a horizontal surface directly from the sun and diffusely from the sky ( $Q$ ), and the diffuse sky radiation alone ( $D$ ); the net loss of heat due to the difference between the long-wave outward radiation from the surface of the earth and radiation of corresponding wave length to the earth from the atmosphere ( $R$ ); the evaporation from the surface of the earth, and the reflection from snow surfaces.

From measurements of  $Q$  made since June, 1922, and records of the duration of sunshine,  $n$ , since 1908, the relation

$$Q_s = Q_o (0.25 + 0.75 S) \quad (1)$$

has been determined, where for a given day or a given month,  $Q_s$  is the average radiation receipt,  $Q_o$  the radiation that would have been received with a cloudless sky of average clearness, and  $S = \frac{n}{N}$ , where  $n$  is the number of hours of sunshine recorded by a modified Jordan photographic recorder, and  $N$  is the possible number of hours of sunshine.<sup>1</sup>

TABLE 1

	Monthly evaporation, mm.	Heat of evaporation	Reflection from snow surface	Outgoing radiation	Radiation income			9-6
					3+4+5	Sun	D (sky)	Q (total)
January.....	7	420	420	3,570	4,410	180	670	850
February.....	8	480	1,210	3,600	5,290	787	1,723	2,510
March.....	15	900	2,030	3,900	6,830	2,640	1,870	4,510
April.....	28	1,680	1,250	4,320	7,250	5,600	3,250	8,850
May.....	47	2,820	4,950	7,770	9,420	3,035	12,455	+4,685
June.....	67	4,020	4,900	8,920	9,350	2,820	12,170	+3,250
July.....	73	4,380	4,470	8,850	8,520	3,040	11,560	+2,710
August.....	61	3,660	4,050	7,710	5,900	3,250	9,150	+1,440
September.....	40	2,400	4,110	6,510	3,640	2,750	6,390	-120
October.....	23	1,380	120	3,510	5,010	1,166	2,970	-2,040
November.....	13	780	200	3,420	4,400	226	1,000	1,230
December.....	8	480	270	2,940	3,690	47	690	740
1	2	3	4	5	6	7	8	9
								10

The values in columns 3 to 10, inclusive, are expressed in gram-calories per square centimeter of horizontal surface.

The measured values of ( $Q$ ) and ( $D$ ) for Stockholm have been smoothed by equation (1), and the monthly

mean results are reproduced here in Table 1 under "Radiation income."

In the same way it is shown that the average outgoing radiation  $R_m$  may be determined with reasonable accuracy from the equation

$$R_m = R_o (0.25 + 0.75 S) \quad (2)$$

where  $R_o$  is the loss with a clear sky and  $S$  has the same significance as in equation (1).

The monthly mean values of  $R_m$  for Stockholm are given in Table 1 under the heading "Outgoing radiation."

The author shows that  $Q_o$ ,  $Q_s$  ( $=Q_m$  for monthly values), and  $R_m$  may be represented by Fourier series as in Table 2.

TABLE 2.—Values of constants in formula

$$A + a_1 \sin(\phi + x) + a_2 \sin(\phi + 2x) + a_3(\phi + \sin 3x)$$

	A	a <sub>1</sub>	φ <sub>1</sub>	a <sub>2</sub>	φ <sub>2</sub>	a <sub>3</sub>	φ <sub>3</sub>
Q <sub>o</sub> .....	10,780	9,050	295.1	295	164.5	440	°
Q <sub>m</sub> .....	6,100	6,130	296.5	590	170.2	440	154
R <sub>m</sub> .....	3,980	780	305.2	90	206.5		109
Q <sub>m</sub> -R <sub>m</sub> .....	2,120	5,380	295.5	520	164.3		
W.....	-270	3,740	295.2	800	185.2		

The values of  $Q$ ,  $R$ , and  $W$  are given in gr. cal. per cm.<sup>2</sup>;  $x=0^\circ$  and  $360^\circ$  on January 15.

The quantity  $Q_m - R_m$  is designated by the author the "heat effective net radiation." Its monthly mean values may be found by subtracting values in column 5, Table 1, from values in column 9. The resulting values of  $Q_m - R_m$  may be represented by a series, the constants of which are given in Table 2.

If we deduct from  $Q_m - R_m$  the heat lost through evaporation from the surface of the earth and through reflection from the snow-covered surface, the monthly means of which are given in columns 3 and 4, Table 1, we obtain the "temperature effective energy," or  $W$ , the monthly mean values of which are given in the last column of Table 1. The constants of the Fourier series for  $W$  also are given in Table 2.

The author's discussion of Table 2 follows:

The table is instructive in many respects. It shows that the amplitude<sup>2</sup> of the second term, the whole-year term, as regards the total incoming radiation from sun and sky under the condition

<sup>1</sup> The equation obtained by the reviewer from monthly mean values of  $Q$  recorded by the Callender recording pyrheliometer and of  $n$  recorded by the Marvin sunshine recorder is  $Q_s = Q_o (0.22 + 0.78 S)$ . See Monthly Weather Review, 47:780, Figure 9, November, 1919.

<sup>2</sup> Amplitude here and in the following is equal to  $a_1, a_2, a_3 \dots$  and consequently equal to half the difference between maximum and minimum values.